Making the Economic Case for Residential Fire Sprinklers

To the Citizens of Tualatin Valley Fire & Rescue

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Certification Statement

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

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Abstract

Residential fire sprinklers are readily identified as an effective life saving tool for the citizens fire departments across the country serve. When it comes to the financial pros and cons there tends to be more debate. The problem in this research paper is Tualatin Valley Fire & Rescue had not identified the cost effectiveness of residential sprinklers to develop an effective strategy regarding these systems. The purpose is to identify the cost effectiveness of residential fire sprinkler systems to develop an effective strategy to reduce loss of live and property damage that properly weighs the contribution residential sprinkler systems could make.

Descriptive research was used to investigate the following: a) what effects do residential sprinkler systems have on insurance rates? b) What is the overall economic model for fire insurance in the State of Oregon? c) What factors influence the overall cost of sprinkler system installation? d) What have fire departments and the fire industry associations done to educate the insurance and building industry of residential fire sprinkler systems? e) what has been the experience of property and life lost from fire in single family residential dwellings where a working fire sprinkler was present or not? The results were that fire insurance is not affected substantially by sprinklers and there is no real connection to the insurance industry. There are considerable gaps in perceptions around sprinkler systems. Education and outreach should be the top priority in the future. Partnering with the building, real estate, and insurance industries will be key issues. Sprinkler systems in single family residences are rare. The fire service must increase useful data regarding the performance of these sprinkler systems and the outcomes when the sprinklers are not present. The data that exists puts a positive light on the outcomes with sprinklers. It is up to the fire service to sell it.

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Introduction

Residential fire sprinklers in one and two family dwellings have long been a controversial subject. After the release of *America Burning* outlining America's fire problem, the National Fire Protection Association (NFPA) produced the Standard for Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes (NFPA 13D). Although these systems have been in effect for decades, they are not commonplace in one and two family residences within Tualatin Valley Fire & Rescue (TVF&R). The current residential code has allowed for these systems, but builders are reluctant to install them, and the consumer does not see the need or the financial case. This research is intended to support the United States Fire Administration (USFA) goal of reducing risk at the local level through prevention and mitigation.

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Descriptive research was used to investigate the following questions: a) what effects do residential sprinkler systems have on insurance rates? b) What is the overall economic model for fire insurance in the state of Oregon? c) What factors influence the overall cost of sprinkler system installation? d) What have fire departments and the fire industry associations done to educate the insurance and building industry of residential fire sprinkler systems? e) What has

been the experience of property and life lost from fire in single family residential dwellings where a working fire sprinkler was present or not?

Background and Significance

Tualatin Valley Fire & Rescue (TVF&R) is a rural fire protection district in the greater Portland Metropolitan region of Oregon. Serving nine cities and unincorporated areas of three counties, TVF&R provides fire and emergency medical response to a current population of 440,000 people over 210 square miles. TVF&R responded to more than 33,000 calls from 21 fire stations last year and has additional support staff at three operating centers and a training facility. TVF&R is a combination fire department with 319 career firefighters, 88 volunteer firefighters and 100 administrative support staff. Response staff deploy from 25 engines, 3 trucks, 1 heavy rescue, 3 medic units, and 4 cars. TVF&R's staff works with local building officials on fire code and new construction issues in the 12 different cities and counties it serves. Oregon currently uses the 2006 version of the International Residential Code (IRC) with a 2008 version of the Oregon Residential Specialty Code (ORSC), which has Oregon specific code amendments. Oregon is in the process of adopting the 2009 edition of the IRC with the potential for exclusion of residential fire sprinklers. There are no municipalities within TVF&R's service area that have an adopted single family sprinkler amendment.

Historically during the last two decades, TVF&R has responded to several deadly fires causing the loss of more than two dozen lives. Although TVF&R has pushed information through media and worked with the Oregon Home Builders Association (HBA) on incentives and other local governments, there has not been significant installation of residential sprinkler systems in single family dwellings. Many reasons for this have been identified, some economic

and some information and misinformation regarding sprinklers. Last year, TVF&R developed a report titled *Study of Cost Implications Associated with a Voluntary Residential Sprinkler System for New Construction*. TVF&R has had some successes in mandating residential sprinkler systems in multifamily dwellings, such as apartments, but that was only after a rash of apartment fire fatalities. In 2003, the City of Wilsonville (City) in TVF&R's service area approached Fire District staff to discuss a new community they wanted to develop. With TVF&R's concurrence to use tax increment financing, the City would make this new development (Villebois) a 100% fire sprinklered community with financial offsets to the builders to make the sprinkler systems more affordable. Although the 2,600 homes in this development will have this life saving tool, the City does not have a sprinkler ordinance. Oregon does not have specific requirements on who can design and install a residential sprinkler system. Currently, a homeowner or a builder/plumber can design the system and install. There have been discussions at the state level as to whether the design of the system should reside with a professional engineer or someone with additional certification.

Presently, inside TVF&R's service boundary there are plans for dramatic growth through expansion in the urban growth boundary and potential for refill or redevelopment at a higher density level inside the existing urbanized areas. The deployment needs of a fire department with a sprinklered community versus one that is not sprinklered would be measurably different. In order to financially operate in the years to come TVF&R needs to have practices in place that ensure the health and safety of the citizens it serves. In order to develop an effective strategy to ensure all new construction is equipped with residential sprinkler systems, TVF&R must first understand the economic model behind these systems and factors that influence the decision to install them. Nationally, this topic has been debated widely. The International Code Council has

placed a requirement in the 2009 edition of the IRC for single family residential sprinklers. In Oregon, the Building Codes Division is poised to remove this requirement from the code and the ability for a local jurisdiction to adopt the requirement for sprinklers. This research is intended to support the United States Fire Administration (USFA) goal of reducing risk at the local level through prevention and mitigation.

Literature Review

Automatic fire sprinkler systems have been commonplace in commercial structures for over a hundred years. However, statistically, we know that most fires occur in residential dwellings. In fact the National Fire Protection Association (NFPA) reports that of the 350,000 home fires that annually occur nationally, 2,500 people will die in these fires (Karter, 2010). People in homes with sprinklers are also protected against significant property loss. Sprinklers reduce the average property loss by 71 percent per fire (Karter, 2010).

Residential fire sprinklers are designed based on NFPA 13, which is the Standard for Installation of Sprinkler Systems in One- and Two- Family Dwellings and Manufactured Homes. NFPA 13 was originally adopted as a standard at the 1975 NFPA annual meeting in Chicago, Illinois. This standard was created in response to the release of *America Burning* where the report stated "where early warning detectors and automatic extinguishing systems are used in combination, the protection of lives and property is enhanced greatly over that afforded by detectors alone." It was for that reason the Commission recommended that the proposed U.S. Fire Administration support the development of the necessary technology for improved automatic extinguishing systems be acceptable to Americans in all kinds of dwelling units (The National Commision on Fire Prevention and Control, 1973, p. 120). It was the commission's

report that showed that savings in fire insurance and overall costs of fire protection were an added benefit in 1973. NFPA 13D is now in its 2007 edition, which includes many enhancements over the years. It has done what the National Commission on Fire Prevention and Control had hoped back in 1973. It had created systems that are cheap and acceptable for all types of dwellings.

Sprinkler systems have become more affordable due to the advancement of modern construction practices. The sprinkler industry have created multipurpose sprinkler systems in single family construction, which has driven down the cost of these systems compared to the older stand alone systems. Multipurpose sprinkler systems are incorporated into the regular domestic plumbing system, which increase the efficiency of the plumbing, reduce maintenance, and reduce susceptibility to freezing in cold climates. The NFPA completed a report titled *Comparative Analysis of Housing Cost and Supply Impacts of Sprinkler Ordinances at the Community Level*. In this report they research the market effects on residential housing where sprinkler systems are required per ordinance. They utilized data from Prince Georges and Montgomery Counties in Maryland and Virginia, which has had a sprinkler ordinance since 1987. The data showed that after each update of these municipalities' sprinkler requirements, there were no corresponding reductions in the number of single-family homes built in either county, relative to their neighboring counties in Maryland and Virginia (Weatherby, 2009). In fact these municipalities actually saw a larger relative increase in construction the year after regulations became effective compared to their neighboring counties without such sprinkler ordinances (National Fire Protection Association, 2009).

Another report was completed by Tualatin Valley Fire & Rescue in 2009, where they commissioned a report titled *Study of Cost Implications Associated with a Voluntary Residential*

Sprinkler System for New Construction. This report outlines what a voluntary program for the installation of residential fire sprinkler systems in new construction could look like. Utilizing a broad base of support from strategic partners including municipal agencies, TVF&R commissioned an independent study to evaluate the cost differences (per square foot) between the installation of residential fire sprinklers in new residential construction and the potential incentives available through incorporating design, alternative methods, and materials if sprinkler systems were installed. This was based on construction inside the Fire District's boundaries. Findings of the report showed what factors influence sprinkler costs and potential off site and on site incentives that could be offered due to sprinkler installation to drive down the overall costs. Factors of significance were the system development charges incurred due to the need to utilize a larger sized water meter. Some water purveyors inside TVF&R's service area waive the up-charge if it is only required for residential fire sprinklers, some do not. Depending on which one of TVF&R's nineteen water service purveyors is involved, the charge can be as much as an additional eight thousand dollars (W&H Pacific, 2009).

When determining the economic factors for single family residence sprinkler systems, one area that affects the consumer costs is their homeowner insurance. The insurance industry in Oregon is regulated through the Oregon Insurance Division. The Oregon Insurance Division's mission is to ensure the financial soundness of insurers and promote the availability and affordability of insurance and the fair treatment of consumers (Oregon Insurance Division, 2010). On review of the material that regulates single family dwelling insurance rates, it was found that a large factor is the Insurance Services Office (ISO) Public Protection Classification Program (PPC). ISO rates all fire departments in Oregon and submits that rating information to the State of Oregon Insurance Division. That rating is based on information ISO finds on their

analysis of the fire department through the fire suppression rating schedule program (FSRS). The rating is scored from 1 to 10, with 1 being the best possible rating. The rating is based on three areas: 1) receiving and handling of alarms, which is related to dispatch and tap-out systems; 2) fire department, which covers topics of pumpers and pump capacity, ladder trucks, distribution of companies, number of staff, and training provided; and the third area being water supply, which is adequacy of water supply and hydrants, water main sizing, and maintenance. Nothing in the FSRS process looks at fire protection features of dwellings such as residential sprinkler systems (Insurance Services Office, 2010). In Oregon, ISO provides ratings information to seventy percent of the insurers in the state (C. Newell, personal communication, December 2, 2010). The rest rely on internal loss statistics and data or contract with a rating bureau other than ISO. Data has shown from Scottsdale, AZ that the average property loss in a structure with a sprinkler system is ninety percent less than a structure without a sprinkler system (Ford, 1997).

The national fire service has taken steps to educate the various groups about residential fire sprinklers. Those attempts have varying degrees of success. Through the efforts of the US Fire Administration and NFPA, several informational resources have been created. One such resource is the Fire Sprinkler Initiative by NFPA, which is a website resource for all audiences. It hosts educational information with real life examples and resources and shows the facts about residential fire sprinklers (National Fire Protection Association, 2010). The NFPA has also begun an outreach program where they are traveling the fifty states to show side-by-side comparisons of dwelling fires and outcome with and without residential sprinklers. These resources have helped to educate the various industries and the public about the pros and cons of residential fire sprinklers.

Procedures

The type of research used to answer the research questions was descriptive research. The first phase of the process was an analysis of previous applied research through a study of the National Fire Academy Learning Resource Center. Additionally, there was an analysis of internet resources through the many fire service associations focusing their research in the area of residential fire sprinklers.

In order to determine what factors are used to set fire insurance rates for one and two family residences internal to TVF&R's service area, and what the overall economic model is for fire insurance companies in Oregon, several procedures took place. The process to find this information was to interview several different insurers who cover properties in TVF&R's service area. Questions they were asked included: a) do you offer homeowners insurance to one and two family residential homes inside Tualatin Valley Fire & Rescue's service area? 2) What factors drive fire insurance rates? 3) What discounts does your company offer for residential fire sprinklers? 4) What educational information have you seen about residential fire sprinklers? Companies polled were AAA, AIG, Allied, All State, American Family Insurance, Country Financial, Famers Insurance, Foremost, Geico, Hartford, Liberty Mutual, Met Life, MIS, Mutual of Enumclaw, Nationwide, Oregon Mutual, Safeco, Travelers, USAA, Sublimity, and State Farm. Additional information was gathered from the Oregon Insurance Division and the Insurance Services Office of copyrighted information through site visits. Interviews of Oregon Insurance Services Staff were also conduced and included interviews of Cece Newell, Property Casualty Technician in the Market Regulation section of the Oregon Insurance Division, and David Dahl, Casualty Actuary from the Oregon Insurance Division. Research findings for the third question of what factors influence the overall cost of sprinkler system installation were

gathered from information polled from local municipalities, the local building industry. Questions asked were what factors increase the cost of residential sprinkler systems? What level of demand do you see for sprinkler system installation? What factors could be put in place to decrease the cost of residential sprinkler systems? A survey of price structure was sent to local water purveyors inquiring as to the charge for upsizing the water meter if required specifically for residential fire sprinklers. The final question, what has been the experience of property and life lost from fires in single family residential dwellings where working sprinklers were and were not present, was gathered from statistical data on single family structure fires with and without residential sprinklers in the state of Oregon and TVF&R's service area.

The limitations of this research is that insurance rate setting is proprietary information and not public. Some information on philosophy of rates and rate structures can be found. The other limitation is the Insurance Services Office is a for-profit company and much of their information and data bases are proprietary also. Another complexity is TVF&R, being a fire district, does not have any jurisdiction in local building codes. TVF&R is reliant on local adoption and enforcement of national and state code sets.

Related to statistical data there are several areas that create limitations in the accuracy or usefulness of the data. The State of Oregon has just recently started to collect data relevant to this subject area. The specificity of the data was very broad in years past and due to the small data set, there are complications with it. The other factor is the relatively small number of residential sprinkler systems installed both in the state and in TVF&R's service area is difficult to track. Local building departments have not collected information on these systems as many of the multipurpose sprinkler systems do not require any special permitting and are reviewed as part

of the general plumbing system and permit. Data on these systems is difficult if not impossible to harvest from the building department databases.

Results

The results of the findings were somewhat limited. The first question, what effects do residential sprinkler systems have on insurance rates, was answered by polling insurance companies who insure properties with TVF&R's service area. When it came to the effect those residential sprinkler systems have on an individual's homeowner insurance, it was minor. Residential sprinklers are treated the same as smoke alarms, dead bolts, and monitored fire/burglar alarms. The maximum discount the insurance companies were willing to offer ranged from two to sixteen percent. Insurance discounts range from five to ten percent based on sprinkler system coverage nationally, according to National Association of Home Builders. The insurance companies polled reported the total discounts allowed went to a maximum of 20% under the title of "protective devices," which is smoke and burglar alarms, sprinkler systems, etc. Statements made by insurance agents were that monitored smoke alarms were of the same effect as a sprinkler system because the fire department is notified and responding. To illustrate the point, one insurer stated that in a $300,000 single family home where the annual homeowner's policy would be around $750, the difference in the annual premium for that home with and without residential fire sprinklers was $15. The overall factor that drives homeowner insurance rates is the fire protection classification or loss data in the case of State Farm Insurance. The two most common questions the insurance companies wanted to know were a) if the residence was within five road miles of a fire station; and b) if the residence was located within 1,000 feet of a fire hydrant. Two companies, Hartford and Travelers refused to sell insurance to a home with residential sprinklers due to the increased risk of water damage. Research gathered from the

Oregon Insurance Division stated that ISO is not willing to provide any information on how rating classifications are determined other than the general information available on their website (ISO). ISO is willing to work with any fire department to offer suggestions to lower their FSRS rating level. Overall, fire claims have become a smaller portion of homeowner claims due to good fire prevention, education, and response. The larger factors that drive overall homeowner rates are liability claims, vandalism, theft, water damage, and weather related claims that are non-fire property losses. Fire sprinklers are also not recognized in premium calculations due to the fact they are primarily installed in new construction. Newer homes already have lower rates due to new electrical systems, drywall, insulation, and other factors that make a home more fire resistive. Overall, newer homes have a lower risk of fire than an older home. Another point related to ISO PPC classification is many insurance companies' group classifications for rate structure. ISO classes 1, 2, and 3 are the same price for residential. ISO class 4, 5, and 6 are the same price, and ISO 7, 8, and 9 are each priced independently. For this reason, improvements for a fire department to go from an ISO class 3 to an ISO class 1 would have little to no effect on residential insurance rates.

A detrimental effect is some insurers will lower fire insurance for residential fire sprinklers but raise the rate for water damage coverage. Residential fire sprinklers do not account for enough of the historical claim data to make a positive change in the overall premium calculation. The number of overall claims makes residential fire sprinklers statistically irrelevant in TVF&R's service area.

The second question, what is the overall economic model for fire insurance in the State of Oregon is answered with similar responses. The Insurance Division purpose is to ensure the insurance providers stay solvent financially. They do monitor historical patterns to quantify the

rates insurers charge, but they rely to a large extent on the ratings bureaus to determine the information. ISO is currently seventy percent of the insurance business in Oregon today and increasing. At one point historically they were eighty five percent. The State Insurance Division does not have a defined process to check the ratings bureau for accuracy. The ratings bureau files information related to the rating schedule once per year. It is copyrighted material and although public, cannot be reproduced. The information available in the document is also very limited, only showing city, county, or district with PPC rating and any notes related to water supply or fire station info.

The results of the factors that influence overall cost of sprinkler system installation are fairly limited. The cost of the actual system is tied to the same plumbing material costs because they are part of the same system. The largest factor has been the fee that is paid when the water meter size is increased exclusively due to the fire sprinkler system. Although some water purveyors waive the system development charge (SDC) upsize charge if fire sprinklers are the reason, some do not and the charge can be expensive. In TVF&R's service area those charges range from no charge to $7,846 in system development up charges alone.

Table 1 includes relative data on water meter system development charge for upsizing.

Municipal Agencies that do NOT charge additional System Development Costs (SDCs) when meter size increases due to installation of a residential fire sprinkler system			
Municipal Agency	**¾" Meter**	**1" Meter**	**Upgrade Difference Not Charged**
Rivergrove	Not available	$6,538	N/A
Sherwood	$6,319	$15,800	$9,491
Tualatin	$3,143	$7,859	$4,716
Wilsonville	$4,436	$6,652	$2,216

Municipal Agencies that DO charge additional System Development Costs (SDCs) when meter size increases due to installation of a residential fire sprinkler system			
Municipal Agency	**¾" Meter**	**1" Meter**	**Upgrade Charges Incurred**
Beaverton	$4,770	$7,900	$3,130
Tigard	$4,705	$12,551	$7,846
Tualatin Valley Water	$8,309	$9,305	$996

Only one community inside TVF&R's service area was found to be installing residential fire sprinklers. It was in the City of Wilsonville where they have a new development being built (Villebois), which has been under construction since 2004, and home sales have been slow due to the economy. There is an intergovernmental agreement between the City of Wilsonville and TVF&R in place, which created an SDC offset of $1.21per square foot to cut the cost of adding sprinkler systems in every home in this development. This offset eliminated the $2,216 up charge that a typical home in Wilsonville would have received. There are 2,600 homes planned on final build out (Newport Partners LLC, 2010). The offset has lowered the overall cost of the sprinkler system to a range of $0.81-$0.89 per square foot, well below the $1.61per square foot national average rate. Another factor identified by the Home Builders is the number of subcontractors that install residential sprinkler systems is somewhat limited. This has an overall

effect on the price of labor as currently there is not competition in the market. The level of demand for consumer requests for residential sprinkler systems is nonexistent according to HBA. Because of the additional cost and fees with the consumers' desires to stretch their dollars for upgrades in finish and amenities, sprinkler systems are not being called for. Even in the Villebois development, which is one hundred percent sprinklered, the builder and realtors do not refer to the sprinkler system in any of their marketing materials. When asked what factors could be put in place to decrease the cost of sprinkler systems, the HBA referred to construction tradeoffs that could decrease the overall cost of development, the HBA offered tradeoffs such as higher density, skinny streets, fewer hydrants, changes in fire and life safety code requirements unnecessary if sprinklers were used, etc., could lower the overall cost of adding residential sprinklers.

The results of question four, what have fire departments and the fire industry associations done to educate the insurance and building industry of residential fire sprinkler systems, was found to be limited. There has not been a strategically planned education campaign for these groups. Many instances of misinformation still exist and overall the fire service has done a great job of pushing smoke detectors and most of the general public does not see the association of sprinkler systems necessary if they have a working smoke detector. During a conversation with Liberty Mutual insurance regarding discounts, if a homeowner had smoke detectors and they were electronically monitored, they received a 16% discount. If the homeowner had residential sprinklers, they received a 16% discount. However, only twenty percent was allowed total for "protective devices," so with all homes required having smoke detectors, and most having dead bolts, if the homeowner monitored the security system with the smoke detector, the sprinklers were only worth a 4% discount overall. The information on national trends that sprinklers cut

overall losses by 50% or more did not change the insurance rate. Of the insurance companies polled, many did not understand why a homeowner would want to install a sprinkler system, as it their belief is that it could cause more damage than it would save in regard to associated water damage. They also believed all sprinkler heads activate in the home when the system goes off. The HBA felt there is a need to for increased education in their industry regarding home fire sprinkler systems as well. They also felt the use of smoke detectors was sufficient and additional requirements were not necessary.

The fifth question regarding what has been the experience of property and life lost from fire in dwellings where a working fire sprinkler was present or not has limited data. One factor is that there are very few single family residential sprinkler systems in the state of Oregon and within TVF&R's service area. That is coupled with the fact that the few numbers that exist would have had to have a structure fire, and that data would need to be recorded. Up until this year, that data was not recorded in Oregon specific to residential structure fires with sprinklers. Overall in 2009, there were 2,379 one and two family residential structure fires in Oregon, with 335 of those occurring in TVF&R's service area. Two of the 335 structure fires in 2009 where TVF&R responded were in one and two family dwellings with sprinklers. Neither fire became large enough to activate the sprinkler system. In fact, over the last ten years, TVF&R has responded to 11 fires in one and two family dwellings equipped with residential fire sprinkler systems. In three of the cases the system operated and was effective; in seven cases the fire was too small to activate the sprinkler system; and in two cases the sprinkler system did not operate due to the fire occurring in an area that was not protected by the sprinkler system, for example in the garage.

Discussion

In researching this topic, the information found follows closely with other research discovered during analysis and review. In some cases, the points of national research are over stated when you look at the business case for fire sprinklers. The research conducted looked at the price to install and savings that could be received from these systems. It did not look at the human element of the lost earning potential of a life lost in a residential structure that could have been spared if a sprinkler system was present. That issue has been debated in the past and it is very difficult to quantify those factors. So much of the future earning potential of an individual is driven by many more factors than if they have a residential sprinkler system. Clearly, there is a value there, but much of it is hard to quantify.

In researching the impact of residential sprinklers on fire insurance rates the study results did in fact mirror what others had researched. Oregon is not abnormal in how the insurance industry is priced and monitored by state government. The author was surprised how little residential sprinklers influence the overall price, in that the national studies had shown 8% to 13% savings (C. Grindle, personal communication, December 16, 2010) on homeowners insurance, which is accurate, but when one factors in the other features that standard residential structures have, dead bolts, smoke detectors, etc., the savings are closer to 2% to 5% savings. When consumers are looking at the price to add an amenity to their home, such as a residential sprinkler system and the payback is based on a $15 annual savings, the author wonders if public perception would find it is worthy of the expense based on price alone. Clearly, the expense of a system to save a life would be worth the price of a system, but that factor does not come up in the literature around the price of a residential sprinkler system. Insurance rates are based on the experience rating of the whole, meaning that all single family dwelling with and without

sprinklers drive the rate. The other data points that drive the factors that influence homeowner insurance rates are not related to residential fire sprinklers (C. Newell, personal communication, December 2, 2010). In discussions with Robert Cobb, National Director with ISO, there is a revision of the PPC in draft form that could include changes to the formula, allowing for credit if a community has passed a sprinkler ordinance, and would allow for reduction in fire flow requirements due to fire sprinklers for those structures. Much of the information that influences insurance rates is proprietary and difficult to understand. Long-term, the data shows that it will take some time for residential sprinkler systems to influence insurance factors. In communities that have fire sprinkler amendments, such as Prince Georges County, the number of residential structure fires where a home is equipped with a residential sprinkler system was only 1.81% of all residential fires over the last 15 years (Weatherby, 2009). Although the statistics of these incidents is positive on the minimized loss of property and life, it will not have a significant change on homeowners' insurance rates. Prince Georges County's homeowner rates are in line with the rest of the national averages. The implications of the results for TVF&R create the need to better understand all the facts related to insurance and what drives rates. Currently, the revision of the ISO Fire Service Rating Schedule is up for comment (Insurance Services Office, 2010).

The second question on the overall economic model for fire insurance in the state of Oregon was also consistent with other information in the research. The State Insurance Division is in place to ensure the long term economic vitality of insurers. The division is not in place to ensure a competitively priced market. Although they do handle complaints, they do not debate the methodologies behind rate setting, ratings bureaus and insurance policies and procedures.

The results of the factors that influence overall cost of sprinkler system installation again were consistent with prior research. This issue has been debated nationally and the overall market for these systems is driving down the cost. Both in Scottsdale, AZ and Prince Georges County, MD, the price for sprinkler installation dropped over time due to frequency of installation. In the case of Prince Georges County, it dropped to below $1.00 per square foot (Weatherby, 2009). In the case of the Villebois project in TVF&R's service area, the cost of installation was also well below one dollar per square foot with the incentive provided (Newport Partners LLC, 2010). Scottsdale's experience was that the cost of a sprinkler system installed was $1.14 per square foot when the sprinkler amendment was implemented. Over the years, that price has continued to drop and recently, TVF&R Fire Prevention staff noted the price had dropped to $0.30 per square foot for material and eight hours of additional labor (K. Stoller, personal communication, December 22, 2010). The total price was approximately $3,000 dollars added on to the home price of $300,000. This information is also consistent with the finding in the research where as demand increases, price tends to decrease. To put the price of a sprinkler system into perspective, based on Scottsdale's history, a home with a residential fire sprinkler system mortgaged for 30 years would pay an additional $4.37 per month in mortgage payment, or the equivalent to a Starbucks coffee over a home without a sprinkler system (K. Stoller, personal communication, December 22, 2010). The implications of these findings for TVF&R are positive. TVF&R has long worked with the HBA to drive down the cost of construction and based on the findings of both the study data and the literature review; there is clear understanding of how the price per square foot can be decreased. Currently, there are concepts for legislation that would decrease the system development up-charge for increasing the size of the water meter when the only reason for the larger meter is the residential fire sprinkler system.

The fourth question dealt with what the fire department and fire service associations had done to educate the insurance and building industry regarding residential sprinkler systems. What was discovered was that the study results matched the literature review. There are several resources available now, but prior to the 2009 ICC hearing to put fire sprinklers into the residential building code, education and outreach was limited. TVF&R has had some residential fire sprinkler campaigns, especially after several fire deaths in multifamily housing. There has not been a coordinated educational campaign across the building and insurance industries to change the perceptions. Also, at this point, the building industry is in a defensive mode of fighting residential sprinklers and not as receptive to the information. TVF&R has been discussing the facts, myths, and what can be done to help the building industry (W&H Pacific, 2009). The local relationship with the HBA is good and this will have positive implications on the relationship moving forward. The future success of implementation of residential sprinkler systems is critically tied to a comprehensive educational strategy. In the absence of a complete plan, the success will be limited.

The experience of property and life lost from fire in dwellings where a working fire sprinkler was present or not, does appear to track sufficiently with study results and literature review. There is a significant gap in the quality of the data available. Although fire loss statistics are tracked in both the state of Oregon and TVF&R, they were not recorded with building and contents value until this year. This has made the measurement of data much more difficult. That coupled with the lack of instances with fire occurring in single family residential dwellings with sprinkler systems in the state makes local data inconclusive. For the purpose of this research, the author cannot find any reason why the literature review is not accurate and the

implications of this information on the organization moving forward is that data collection must be a top priority.

Recommendation

To question the recommendation of fire sprinklers in residential use in the fire service would sound like blasphemy to most. It is very important to the success of the profession and the recommendations that are made are backed up with solid evidence and make economic sense. The consumer has become smarter and has so many different resources to gather information and make decisions. It is important that it is understood what effects are caused by the initiatives the fire service is pushing.

Based on the research, the following recommendations are being made by the author. A comprehensive educational and marketing plan should be created for residential fire sprinklers in one and two family dwellings. The building code does not currently make installation of these systems mandatory, so the time should be used in the interim to educate all the different audiences. Consumers, builders, elected officials, local governments, real estate agents, and the insurance industry are some but not all the groups that should be targeted. Consideration for focus groups should be helpful in determining all the factors. The information should be extremely factual and specific to Oregon and TVF&R's service area.

Second, work of construction tradeoffs with HBA should be continued. This work will also help with the marketing aspects of the initiative. Work with local elected officials and building officials on potential tradeoffs that could ultimately create safer communities should be also be continued. This topic is politically sensitive, which means great care should be used to ensure this is a collaborative process and not be construed as punitive.

Third, data collection is extremely important for the long term success of the system. Any changes or modifications to building design and life safety features must be backed up with

solid data. This would also assist in validating the current direction based on comparison with other historic trends. The data capture is very important for TVF&R and should also be retained at the state level. Oregon and TVF&R are leaders in innovation and they should have the data to back it up. Additional data fields should be captured to add extreme detail showing the overall performance of residential sprinklers and the losses that are experienced in homes that are not equipped with this feature.

In conclusion, there is no question that residential fire sprinklers in single family dwellings save lives. There are examples nationally where no one has died in a structure with this life saving tool ever. The question regarding business cases needs to be clearly understood as there are so many competing interests for the dollars spent. The average home buyer is making decisions about the biggest asset they will ever purchase in their lifetime. When making choices around number of bedrooms, hardwood floors or tile, high efficiency appliances or fire sprinklers, without the business case it comes down to a risk management decision to spend available dollars for the consumer, and the fire service may lose that fight.

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